Harsh Maheshwari

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Education

MS in Computer Science **2021–Present**
Georgia Institute of Technology, Delhi, Advised by: ***Dr. Devi Parikh***

Bachelor of Technology in Electrical Engineering, (Power and Automation) **2015–2019**
Indian Institute of Technology, Delhi, Grade: 8.27/10, Advised by: ***Prof. Prathosh AP***

Publications and Pre-prints

5. ***Harsh Maheshwari****, *Shreyas Shetty**, *Nayana Bannur*, *Srujana Merugu*, "CoSIR: Optimal control of SIR epidemic dynamics by mapping to Lotka-Volterra System", under review at **NeurIPS'21**, presented at **CHIL'21 Workshop** and **ICLR'21 Workshop MLPCP** [preprint: 2020.11.10.20211995]

4. ***Harsh Maheshwari****, *Lucky Dhakad**, *Debopriyo Banerjee*, *Niloy Ganguly*, *Arnab Bhattacharya* "Style-Attention-based Compatible Outfit Generation", under review at **BMVC'21**

3. *Shreyas S**, ***Harsh Maheshwari****, *Avijit Saha**, *Samik Datta**, *Shashank Jain*, *Disha Makhija*, *Anuj Nagpal*, *Sneha Shukla*, *Suyash S*, "Audience Creation for Consumables - Simple and Scalable Precision Merchandising for a Growing Marketplace" [preprint: arXiv:2011.08575]

2. *Sansiddh Jain*, *Avtansh Tiwari*, *Nayana Bannur*, *Ayush Deva*, *Siddhant Shingi*, *Vishwa Shah*, *Mihir Kulkarni*, *Namrata Deka*, *Keshav Ramaswami*, *Vasudha Khare*, ***Harsh Maheshwari***, *Soma Dhavala*, *Jithin Sreedharan*, *Jerome White*, *Srujana Merugu*, *Alpan Raval* "A Flexible Data- Driven Framework for COVID-19 Case Forecasting Deployed in a Developing- world Public Health Setting"

1. *Nayana Bannur*, ***Harsh Maheshwari***, *Sansiddh Jain*, *Shreyas Shetty*, *Srujana Merugu*, *Alpan Raval*, "Adaptive COVID-19 Forecasting via Bayesian Optimization", in **CoDS-COMAD'21** [paper: 10.1145/3430984.3431047]

*Equal Contribution

Work Experience

Data Scientist - Flipkart Internet Private Limited **July, 2019 – July, 2021**
Largest E-Commerce platform in India with over 200M users *Bengaluru, India*

- **Complete The Look** (Prof. Niloy Ganguly - IIT KGP, Dr. Arnab Bhattacharya - Flipkart):
  - Generating **fashion-compatible** and **diverse** outfits for a 'hero' product for Indian users and their preferences.
  - Learning compatibility and generating outfits conditioned on 'style'. Two products may be compatible under a certain 'style' and incompatible under another. We are learning the compatibility conditioned on 'style' of an outfit and also generating style-guided outfits. Under review at **BMVC'21**
  - Designed a **beam search** variant using **determinantal point process** to introduce diversity **across outtfits** which is important for a e-commerce platform with users having **different preferences**.
  - Implemented SOTA **fashion-compatibility, apparel segmentation, category classification** models and a flask web tool to get compatibility annotations. (First version to launch soon on the platform)

- **Candidate Generation and Ranking** (Samik Datta, Dr. Adiya Rachakonda - Flipkart):
  - Customized **Bayesian Personalised Ranking based Matrix Factorisation** framework for Flipkart homepage recommendation and designed multiple **Lamda MART** & LR based rankers for Flipkart home and product page. (Improvement in overall conversion by 2bps (units/visits) and 16bps (units/visitor) - won an internal team award based on this work)

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- **Audience Creation for Consumables** (Samik Datta - Flipkart):
  - *Problem:* Creating an audience set for a store for precision merchandising on Flipkart Grocery home page.
  - Designed a novel kernel to capture periodicity in purchase of grocery items (e.g. sugar) to predict purchase probability.
  - Designed and performed large scale experiments on **temporal point process** based precision merchandising algorithm for Flipkart Grocery.

DSIndiaVsCOVID19 **March, 2020 – Present**

A consortium of technologists working as volunteers in collaboration with Wadhwani AI to support public authorities in managing the COVID-19 pandemic by building and deploying technology solutions

- **Forecasting** (Dr. Srujana Merugu - Google Research, Dr. Alpan Raval- Wadhwani AI, Dr. Mohit Kumar- Udaan.com):
  - *Problem:* Given the past case counts of an isolated region, forecast the disease spread dynamics for the next k days.
  - Developed a Machine Learning framework for infectious disease forecasting based on **SEIR epidemiological model variants** with parameters estimated via **Bayesian optimization**. The fitted parameters give less than 10% MAPE error on the forecasts for COVID-19 case counts in Indian districts.
  - *Impact:* The system is being used for COVID-19 medical preparedness in war rooms of heavily impacted Indian cities.

- **Controlling an Epidemic** (Dr. Srujana Merugu - Google Research, Wadhwani AI):
  - *Problem:* Given the medical capacity of an isolated region, create a transmission policy schedule to adaptively control the number of infections in an epidemic.
  - Proposed an analytic control framework based on mapping the SIR model to the well studied **Lotka-Volterra** system and **control-Lyapunov** theory. The framework permits design of policies for adaptive control of transmission rate using non-pharmaceutical interventions that limits the overall disease burden.

TA, Machine Intelligence and Learning, IIT Delhi **July, 2018 – Dec, 2018**
Prof. Prathosh AP *Delhi, India*
- Assisted the professor in designing the course & assignments and grading them for a class of 150 students

Internships

Videoken, Bengaluru (Dr. Meghshyam Prasad) **May, 2018 – July 2018**
Computer Vision, Deep Learning
- Constructed a classifier which used patches of images, inspired by **patchGAN's discriminator**, to classify slides from software demo frames in a video by using **spatial pyramidal pooling** to deal with images of different sizes.
- Built an OpenCV based semi-automated image segmentation tool using **Django Framework** to reduce human efforts for annotating images by employing object tracking. Used to create annotated dataset quickly.
- Achieved high **dice coefficient** by training a U-net for segmenting projected slides out of presentation recordings

Projects

BoardSnapped (Prof. Prathosh AP, IIT Delhi) **Dec, 2017 – July, 2018**
- Formulated educational video summarization problem as a keyframe detection problem
- Extracted hand-crafted features from Images to perform unsupervised binary clustering using **GMMs**
- Divided the problem into two sub-tasks and solved them using **CNNs** and **bi-directional convolutional LSTM** models
- Achieved classification accuracy of **99.3%** and keyframe detection acc. of **97.38%** with precision & recall of **74%** & **77%**. Received highest grade by the panel.

Skin Segmentation from NIR Images, (Prof. Prathosh AP, IIT Delhi) **Apr, 2018 – Dec, 2018**
- To generate skin segmentation dataset for Near Infrared Images trained a **pix2pix** like **conditional GAN** to convert RGB images to NIR images.
- Trained **ResNet38** and **PSPnet** to segment human skiin pixels froom NIR Images to achieve high dice coefficient.

Advanced Machine Learning [Course], (Prof. Prathosh AP, IIT Delhi) **Jan, 2018 – May, 2018**

- **Face Detection and Recognition**: Used **FaceNet** model to achieve an accuracy of **98%**
- **Deep Learning Visualisation** - Visualized representations learned by DNNs through **Saliency maps, Occlusion experiments** & **Inverted Image Representations** and performed **Neural Style Transfer**
- **Speech segmentation**: Detected word boundaries in recorded speech using **bi-directional LSTM** on **TIMIT** database
- **Deep Learning framework**: Built a python based framework without using any deep learning library for creating neural networks and trained MNIST digit classifier

Scholastic Achievements

2015: **JEE Advanced:** Achieved All India Rank of 834 amongst 1.5 million students

2019: **Finalist in Flipkart GRiD** Among 11 finalist teams in 4-stage National level AI/ML Challenge

2018: **Huawei Seeds for the Future:** Among **4 students** from India selected for a 2-week training program in **China**, studied Chinese Language and Culture in BLCU, Beijing and picked up hands-on experience of **5G**, **IoT** and **Cloud Computing** in Huawei Headquarters, Shenzhen

2015: **NSEP top 1%:** Certified for being in **top 1%** out of 37837 in National Standard Examination in Physics (NSEP) organised by Indian Association of Physics Teachers (IAPT)

2014: **K.V.P.Y.:** Secured All India Rank **59** in prestigious fellowship by IISc after national level exam and interview

Technical Skills and Relevant Courses

Relevant Courses: Introduction to Machine Learning, Advanced Machine Learning, Special Topics in Computers - Computational Learning Theory and Mind, Special Module in Machine Learning - Information bottleneck Theory of Deep Learning, Digital Image Processing, Information Theory, Data Structures and Algorithms, Probability, Linear Algebra

Languages & Frameworks: Python, Java, C++, C; PyTorch, TensorFlow, MATLAB; Keras, Scikit-learn; Hive, SQL

Position of Responsibilities

Secretary, NSS IIT Delhi **Apr, 2017 – Jan, 2018**

NSS, IIT Delhi is aimed at motivating students to participate in nation building and social work

- Co-led a team of 4 executives in Animal Care project to conceptualize and organize various sensitizing events in IIT and field trips to animal shelters in **collaboration with an NGO**
- Co-organised NSS orientation for 800+ freshers with a team of 30+ members to introduce NSS

Executive, NSS IIT Delhi **May, 2016 – May, 2017**

- Co-organized **free medical camps** for residents in Munirka Slum and **spread awareness** about common diseases and prevention methods in **collaboration with an NGO**
- Co-designed an ALP internship to **study the behavior of the Indian Society** and help reduce electricity wastage in households. Conducted by **100+ volunteers in 50+ cities** spread all over India

Mentor, Student Mentorship Program, IIT Delhi **Apr, 2017 – Apr, 2018**

- Guided 4 first year students to ensure smooth transition into IIT Delhi